

8.0 IMPLEMENTATION PLANS

Purpose

The purpose of this implementation plan is to outline appropriate steps to achieve the load capacities developed for the pollutants specified in this TMDL document. It is also a plan of action to protect and maintain surface water quality throughout the Upper Rio Chama watershed. Many of the activities that cause water quality impairments (for example, the removal of riparian vegetation) are the cumulative effects of practices causing degradation of the watershed and the affected streams. Some of these impacts have their origins in past events and are compounded by inappropriate land management practices today. The key to changing these practices and improving the condition of the entire watershed is education. An understanding of the attributes of a quality stream environment and a healthy watershed, and how important clean water is to the future of all stakeholders, is an integral part of the process.

This plan for the Upper Rio Chama watershed focuses on prevention and remediation for non-point source pollution – that is pollution that cannot be attributed to a single source such as the outfall pipe of a factory. Previously, individual or discrete projects to address non-point sources of pollution have had limited long-term success. Non-point source pollution control projects are most effective when multiple sources are addressed and activities are coordinated with a watershed plan throughout the affected area. This is because the watershed approach integrates land use, climate, hydrology, drainage, and vegetation effects on water quality. The watershed approach also calls for all stakeholders in the watershed to participate.

Strategy

The mission of the SWQB Watershed Protection Section is to implement progressive watershed-based restoration and protection programs to reduce human-induced pollutants from non-point sources in order to meet water quality standards and beneficial uses of surface water and ground water resources. In recent years, the SWQB Watershed Protection Section has focused its resources to promote a collaborative approach to identifying and reducing the impact of priority non-point sources of pollution.

The first step of this approach is to engage local interest and involvement in locating and defining the problems and implementing the solutions on the land. Table 8.1 lists potential stakeholders in the Upper Rio Chama watershed.

Table 8.1 Potential Stakeholders in the Upper Rio Chama Watershed

Upper Rio Chama Watershed Stakeholders	
Land Owners	
Ranchers	
Crop Producers	
Homeowners	
Businesses	
Land Management Agencies	
Carson National Forest	
Jicarilla Apache Tribe	
Bureau of Land Management Taos Ranger District	
New Mexico Department of Game and Fish	
New Mexico State Parks	
US Department of the Army, Corps of Engineers	
Government Agencies Providing Technical Expertise And Other Resources	
New Mexico Environment Department	
Natural Resources Conservation Service	
Interstate Stream Commission Regional Water Planning	
Rio Arriba County	
Village of Chama	
Village of Tierra Amarilla	
NMSU Cooperative Extension Service	
Soil And Water Conservation District	
US Geological Survey Water Resources Division	
USDI Fish and Wildlife Service	
USDA Farm Service Agency	
Environmental Protection Agency, Region 6	
Interest Groups	
Acequia Associations	
Rocky Mountain Elk Foundation	
Trout Unlimited	
Sierra Club	
Quivira Coalition	
Meridian Institute	
New Mexico Cattle Grower's Association	
Rio Grande Restoration	
Los Rios River Runners	
Northern New Mexico Community College	
Youth Groups	
Boy Scouts and Girl Scouts	
Rocky Mountain Youth Corps	
Youth Conservation Corps	
Local Schools	

Ranchers, crop producers and other private interests own a substantial portion of the Upper Rio Chama watershed. In addition, the Jicarilla Apache Tribe have land holdings and land is also under the jurisdiction of the Carson National Forest, the Bureau of Land Management Taos Ranger District, the New Mexico Department of Game and Fish, New Mexico State Parks and US Department of the Army, Corps of Engineers. The collaborative approach also includes the

involvement of agencies and interest groups that can provide technical expertise, knowledge of the watershed, volunteer labor and other needed resources. Local schools and students and other community organizations and environmental groups can also provide volunteer time and labor.

After all stakeholders are located and provided information about crucial water quality impairments and degradation of the watershed, the next critical step is to engage stakeholders in joining forces to restore the watershed, and identify the “sparkplugs” -- those individuals with the time and the drive to address the challenges concerning the relationship of the community, landholders, and groups to the Rio Chama watershed. These diverse factions are ultimately brought together to form a watershed alliance.

The next logical step will be the development of a locally accepted remediation plan that efficiently achieves pollution load reductions and then maintains and protects water quality from future impairments. This remediation plan or “Watershed Restoration Action Strategy” will document past remedial actions and future restoration projects and activities that will improve the condition of the watershed to meet water quality goals. The involvement of all interests and stakeholders in the development of this plan and unification of community activities through a watershed approach will likely achieve far-reaching and long-term results.

Watershed Goals

The Upper Rio Chama Watershed poses a unique set of conditions that set the stage for restoration. The first and foremost is that the Upper Rio Chama from the headwaters of El Vado reservoir upstream to the New Mexico-Colorado line, and all perennial reaches of tributaries to the Rio Chama above Abiquiu Dam (except the Rio Gallina and the Rio Puerco de Chama), are designated high quality cold water fisheries. This designated use applies to all the impaired stream reaches mentioned in this document. The significance of this designation is that the standards that apply to these surface waters support a superior coldwater fishery habitat and watershed restoration efforts should be focused on this goal.

Perennial tributaries in the Upper Rio Chama watershed include Sixto Creek, Nabor Creek, Rio Chamita, Wolf Creek, Little Willow Creek, Cañones Creek, Rio Brazos, Chavez Creek, and Rito de Tierra Amarilla. Several stream reaches sampled have been characterized as meeting water quality standards (Photo 15). Local landowners can use stream stretches that are identified as meeting water quality standards and designated uses as models or reference condition for restoration goals.

Other designated uses that apply to these streams include domestic water supply, fish culture, irrigation, livestock watering, wildlife habitat and recreational uses such as fishing, wading and other limited seasonal contact activities. Most of the criteria that applies to these designated uses will be met if those of the high quality coldwater fishery are achieved. The water quality criteria and anti-degradation policy that applies to these stream reaches ultimately protects all of these uses.



Photo 15. Stretch of the Rito de Tierra Amarilla upstream of HWY 64 meeting all water quality standards and designated uses.



Photo 16. Stretch of Rio Chama showing stable streambank vegetation.

Management Measures

Management measures are “economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint source pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives” (USEPA, 1993). A combination of best management practices (BMPs) will be used to implement this TMDL.

A general implementation plan for activities to be established in the watershed is included in this document. The Surface Water Quality Bureau’s Watershed Protection Section will further develop the details of this plan. Implementation of recommendations in this document will be done with full participation of all interested and affected parties. Stakeholder and public outreach and involvement in the implementation of this TMDL will be ongoing. Stakeholder participation will include choosing and installing BMPs, as well as potential volunteer monitoring.

During implementation, additional water quality data will be generated. As a result, targets will be re-examined and potentially revised; this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be removed from the 303(d) list of impaired waters.

8.1 Turbidity

Introduction

Turbidity is the reduction of the penetration of light through natural waters and appears as cloudy water. Suspended solids such as clay, silt, ash, plankton, and organic materials cause turbidity in surface waters. Some level of turbidity is a function of a stream’s natural process of moving water and sediment. However, land surface disturbance activities and removal of vegetation can create an environment for erosion of fine soil material that washes into a stream and causes excessive turbidity. Turbidity can harm aquatic life by decreasing light available for plant growth, increasing water temperature, clogging the gills of aquatic fauna, and covering habitat. The turbidity standard addresses excessive sedimentation, which can also lead to the formation of excessive stream bottom deposits that can impact the aquatic ecosystem. Turbidity is a qualitative measure of water clarity or opacity and is reported in Nephelometric turbidity units (NTU). The measured loads for turbidity are expressed in lbs/day of total suspended solids (TSS). The calculated load reduction of TSS to meet water quality standards in Rito de Tierra Amarilla is 1569.3 lbs/day or 48%.

Examples of sources that can cause excessive turbidity include:

- runoff from exposed soil (such as construction sites),
- improperly maintained dirt roads and embankments,
- eroded streambanks,
- activities occurring within a stream channels that re-suspend sediments (such as gravel mining and low water crossings),
- removal of riparian vegetation, and
- naturally occurring situations, in some cases.

Process

Excessive turbidity occurs in the lower Rito de Tierra Amarilla as indicated by samples taken at the lower Rito de Tierra Amarilla station. The Pollutant Source Summary (Table 3.6) lists the land activities in the Rito de Tierra Amarilla watershed that are potentially contributing to excessive turbidity. The potential pollution sources and the resulting degradation to the stream are described further in the Linkage of Water Quality and Pollutant Sources (Section 3.2).

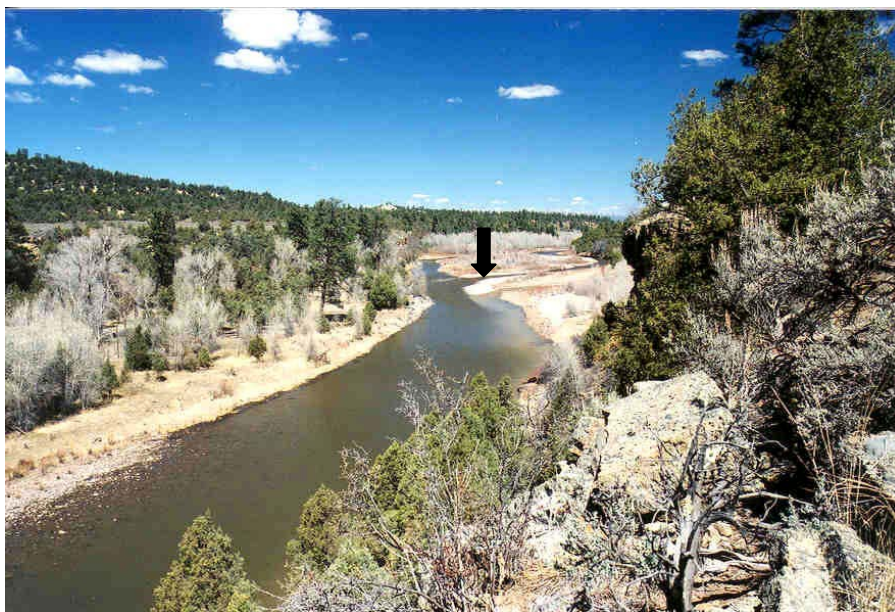


Photo 18. Note plume of turbid water discharging into the Rio Chama from the mouth of the Rito de Tierra Amarilla.

Using the information given in these previous sections and with further reconnaissance by stakeholders and landowners in the watershed, a land treatment strategy should be developed to guide the selection and implementation of Best Management Practices (BMPs) to reduce turbidity. Additionally, because time and funding are critical elements of implementing a plan, critical areas within a watershed or land treatments with the potential to produce significant results should be prioritized.

Agricultural practices have a significant effect on water quality in the floodplain of the lower Rito de Tierra Amarilla. Some of the ways in which agriculture can potentially cause turbidity include contributing sediment-laden runoff from land cleared for farming and in irrigation return flows, overgrazing and trampling of uplands that leads to loss of grass cover and increased bare ground, and removing or trampling of streambank (riparian) vegetation by domestic animals that may lead to bank erosion.

Landowners in the watershed can reverse the erosion process and loss of topsoil by using improved grazing management that lead to more continuous grass cover and less bare ground. Laser leveling of irrigated croplands and the use of buffer strips will reduce sediment-laden runoff from irrigation return flows. With help and technical guidance that members of a watershed alliance can provide, landowners can work to restore appropriate channel sinuosity and stable streambank environments through the installation of vegetative and other in-stream structures. Restoring riparian vegetation not only stabilizes soils along streambanks and floodplains but also attenuates erosive stream power and flood flows. The implementation of practices such as these that reduce turbidity will improve water quality and also benefit the landowner through the improvement of long-term soil productivity, increased organic litter, improved moisture retention, enhanced water infiltration, and reduced soil compaction.

Other strategies that will contribute to reducing turbidity include proper road maintenance practices and drainage controls, relocation of recreation trails away from riparian areas, riparian plantings along streambanks, and hydrogeomorphic river restoration. The SWQB will work with private landowners and community organizations to develop and implement a watershed-wide plan.

Additional sources of information for BMPs to address turbidity are listed below in the Agriculture, Forestry, Riparian and Streambank Stabilization, Roads, Stormwater, and Miscellaneous portions of section 8.5 below. Some of these documents are available for viewing at the New Mexico Environment Department, Surface Water Quality Bureau, Watershed Protection Section Library, 1190 St. Francis Drive, Santa Fe, New Mexico.

Performance Targets

Interim load reduction targets will be used to determine if control actions implemented are successful and standards attained. The interim load reduction targets will be established by the number and kind of BMPs implemented, the number of stream reach miles treated or positively affected by treatment of related areas, and the time it normally takes to see the results of the implemented BMPs. For example, interim load reduction targets for turbidity will be decreased turbidity values as a result of items such as:

- decreased erosion from streambanks,
- increased amount and health of riparian vegetation,
- increased vegetative cover in contributing upland areas, and
- increased miles of properly maintained roads.

In some cases, the results of implementation and maintenance of the most effective BMPs may likely take years to a decade to achieve.

Interim load reduction targets will be established by SWQB staff and will be re-evaluated periodically, depending on type and timing of BMP implementation. Furthermore, these interim load reduction targets will become part of the watershed remediation plan (WRAS). As additional information becomes available during the identification and quantification of the sources of pollution, the targets, load capacity, and allocations may need to be changed. In the event that new data or information show that changes are warranted, TMDL revisions will be made with assistance of the Upper Rio Chama watershed stakeholders. The re-examination process will involve monitoring pollutant loading, tracking implementation and effectiveness of controls, assessing water quality trends in the waterbody, and re-evaluating the TMDL for attainment of water quality standards. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved.

8.2 Stream Bottom Deposits

Introduction

Stream bottom deposits in rivers are the result of excessive sediment carried either from watershed erosion or from eroding riverbanks. Stream bottom deposits become a concern when substantial amount of fine sediment settles on the channel bottom and are not fully flushed out of a river system during storm events (The Georgia Conservancy, TMDL Technical Advisory Group, 2002). Excessive stream bottom deposits fill in and eliminate pool habitat in streams, smothers riffle areas and reduces the overall habitat complexity of the stream. Excessive sediment deposits negatively affect aquatic life. Bottom deposit TMDLs are primarily intended to protect biota and habitat from the physical impacts of sediment.

Stream bottom deposits are measured using a number of monitoring procedures to quantify the narrative standard. Target levels use relationships between percent fines (material < 2mm diameter) and biological score as compared to a reference site. The measured loads for stream bottom deposits are expressed in % fines of the particle distribution within a stream segment. The calculated load reduction of % fines to meet water quality standards is 59% in Rita de Tierra Amarilla.

Clean stream bottom substrates are essential habitat for many fish and aquatic insect communities. Many macroinvertebrates such as aquatic insects and insect larvae, must adhere to hard surfaces such as coarse substrate to live, and/or depend on hard surfaces for feeding. If fine sediment cover the coarser sediment and block the interstitial spaces, macroinvertebrates can be affected by habitat reduction, increased drift during low flow and storm events, and decreased respiration. The result is an alteration of the macroinvertebrate community composition. Riffles tend to be very productive areas for the macroinvertebrates upon which fish feed. If riffles are covered by fine sediment or disturbed too frequently, macroinvertebrate productivity declines with direct effects on fish (The Georgia Conservancy, TMDL Technical Advisory Group, 2002).

The productivity of many fish species is correlated closely to the amount of pool habitat in a stream. Fish tend to congregate in pool areas because the lower water velocities reduce their

metabolic requirements and because the deeper water provides cover against predators outside the stream. Bottom deposits can smother eggs and choke spawning habitats of some fish species.

The following are examples of sources of sedimentation that result in stream bottom deposits:

- runoff from construction activities,
- poorly constructed or maintained roads especially those located in riparian areas,
- poorly constructed culverts, bridges and other river crossings that cause erosion, and act as direct conduits of sediment into the river,
- removal of riparian vegetation causing streambank destabilization and loss of natural vegetative sediment traps,
- recreation areas located alongside rivers, and
- excessive stormwater runoff from urbanized areas
- silvicultural practices leading to unstable unprotected slopes
- straightening of river channels causing erosion by higher velocity flows

Historically, a major contributor to accelerated erosion is due to the destruction of beaver dams and extermination of the beaver. Sediment can become mobilized when beaver dams are breached causing erosion of channel bottoms and banks.



Photo 19. Beaver dam on the Rio Brazos

Process

Excessive stream bottom deposits occurs in the lower Rito de Tierra Amarilla as indicated by samples taken at the lower Rito de Tierra Amarilla station. The Pollutant Source Summary (Table 4.7) lists the land activities in the Rito de Tierra Amarilla watershed that are potentially contributing to excessive stream bottom deposits. The potential pollution sources and the resulting degradation to the stream are described further in the Linkage of Water Quality and Pollutant Sources (Section 4.2).

Many of the strategies that reduce turbidity in a stream also can be effective in reducing the sources of stream bottom deposits. However, sediment such as sand is normally retained within the system longer than finer particles such as clay that are carried as suspended material in the water column. This situation is exacerbated when normal flows that would continue to remove stream bottom deposits are reduced because of irrigation needs. Recovery of biota from the effects of stream bottom deposits may take longer to occur and should be considered when monitoring the effectiveness of BMP implementation.

There are a number of BMPs that can be utilized to address stream bottom deposits, depending on the source of the sediment. Such BMPs include:

- Minimize land use activities in riparian areas that can tear up existing protective ground cover and expose soils to erosion. For example, ruts from vehicles can channelize the flow of water causing gully formation and increased erosion and sedimentation into the adjacent river. (Soil and Water Conservation Practices Handbook, USDA Forest Service, Southwestern Region.).
- Develop water sources for livestock away from riparian areas and stream channels to prevent trampling, and overgrazing and to prevent the animals from disturbing the channel bottom. Also fence streamside areas to allow existing vegetation to recover.
- Promote maintenance and protection of riparian and wetland buffer strips of vegetation between roads and watercourses. In addition to the benefits of riparian areas for shading and bank stabilization, sufficiently wide buffers within the floodplain of the watercourse act as filters to prevent sediment from reaching watercourses during runoff events. (Water Quality Protection Guidelines for Forestry Operations in New Mexico, 1983, New Mexico Natural Resources Department, Forestry Division, 1983).
- Removal of forest and shrub land overgrowth in watersheds allows for the regeneration of a healthy groundcover of grasses. Without these healthy grasslands to provide a surface for water to infiltrate, watersheds can contribute large amounts of sediment that is washed from the land surface or scoured from eroding gullies that drain into watercourses (Watershed Restoration Through Integrated Resource Management on Public and Private Rangelands, Goodloe, Sid. and Alexander, Susan).
- Use water-catchment and water-harvesting techniques in urbanized areas. Catching and storing rainwater through the use of berms, detention ponds, and catchments from gutters and canales can enhance local supplies of water for domestic and agricultural use, can recharge the local water table, can water homeowner's gardens and vegetation, and can prevent sediment and other impurities from entering nearby water bodies. When used

extensively by a community, urban stormwater runoff and the sediment it carries can be significantly reduced.

Additional sources of information for BMPs to address stream bottom deposits are listed below in the Agriculture, Forestry, Riparian and Streambank Stabilization, Roads, Stormwater, and Miscellaneous portions of section 8.5 below. Some of these documents are available for viewing at the New Mexico Environment Department, Surface Water Quality Bureau, Watershed Protection Section Library, 1190 St. Francis Drive, Santa Fe, New Mexico.

Performance Targets

Interim load reduction targets will be used to determine if control actions implemented are successful and standards attained. The interim load reduction targets will be established by the number and kind of BMPs implemented, the number of stream reach miles treated or positively affected by treatment of related areas, and the time it normally takes to see the results of the implemented BMPs. For example, interim load reduction targets will be a lower percentage of fines in the stream bed as a result of items such as:

- a decrease in cobble embeddedness,
- removal of a poorly constructed dirt road from a riparian area, and
- successful bank stabilization efforts in a given reach of river.

In some cases, the results of implementation and maintenance of the most effective BMPs may likely take years to a decade to achieve.

Interim load reduction targets will be established by SWQB staff and will be re-evaluated periodically, depending on type and timing of BMP implementation. Furthermore, these interim load reduction targets will become part of the watershed remediation plan (WRAS). As additional information becomes available during the identification and quantification of the sources of pollution, the targets, load capacity, and allocations may need to be changed. In the event that new data or information show that changes are warranted, TMDL revisions will be made with assistance of the Upper Rio Chama watershed stakeholders. The re-examination process will involve monitoring pollutant loading, tracking implementation and effectiveness of controls, assessing water quality trends in the waterbody, and re-evaluating the TMDL for attainment of water quality standards. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved.

8.3 Temperature

Introduction

Water temperature influences the metabolism, behavior, and mortality of fish and other aquatic organisms. Temperature affects the amount of oxygen that can be dissolved in water, the rate of photosynthesis of algae and other aquatic plants, the rates of growth, reproduction and decomposition of aquatic life, and the sensitivity of organisms to toxic wastes, parasites, and diseases. Normal water temperature varies both seasonally and throughout the day. Local

indigenous aquatic communities are adapted to these natural daily and seasonal temperature fluctuations. However, changes to the normal temperature regime of a stream can eliminate indigenous populations, affect existing community structure and geographical distribution of species, and can support colonization of other species not found in the existing aquatic community.

Human-related pollution can change water temperature to the detriment of the aquatic community. The numeric water quality criterion for temperature of 20 °C (68°F) is applied to streams sampled in this study to maintain the designated use of a high quality cold water fishery and to protect cold-water aquatic life. Recorded maximum temperatures were higher than the criterion on the Rio Chama, Rio Brazos, Chavez Creek and the Rito de Tierra Amarilla by up to nearly 10 degrees Celsius. This temperature increase may kill many of the aquatic organisms that live in these streams. In order to meet the water quality standard, maximum stream temperatures must be reduced on all of these streams. Temperature load reductions expressed in joules/meter²/second are given in Table 5.6.

Some factors that can significantly increase water temperature include summer urban runoff, shallow stream depth, point sources of pollution, turbidity, insufficient shading, decreased base flow, ambient air temperature, and stream orientation (north/south or east/west). The following are examples of causes of temperature increases in aquatic ecosystems:

- reduction of shade caused by removal of streamside vegetation,
- collapse of undercut banks where fish and water are protected from incident sunlight,
- reduction of ground water discharge to the stream caused by reduced infiltration to the local water table,
- excessive turbidity that absorbs sunlight,
- alterations in stream geomorphology leading to a higher width/depth ratio and thus wider/shallower streams, and
- stormwater that flows across hot surfaces such as streets and enters a stream increasing water temperatures

Process

The Pollutant Source Summary (Table 5.7) lists the land activities that are potentially contributing to higher stream temperatures in the stream reaches mentioned above. The potential pollution sources and the resulting degradation that impacts each stream are described further in the Linkage of Water Quality and Pollutant Sources (Section 5.2).

There are a number of BMPs that address temperature, depending on the source of the problem. Many of the same impacts that can contribute to turbidity and stream bottom deposits also contribute to higher temperatures in streams. Below are some remedial actions that may address temperature:

- Reestablishment of appropriate woody and grassy riparian and wetland species applicable to the affected area provides canopy cover and shading for temperature control and helps

prevent streambank collapse. Riparian and wetland vegetation can be restored by planting and seeding and by fencing riparian exclosures, and/or by promoting infiltration that raises the local water table.

- River restoration involving such actions as reconfiguration of the river's sinuosity and/or altering the processes of degradation and aggradation returns the river to a natural and stable morphology which incorporates a lower width-to-depth ratio. This lowered ratio means that the stream has become narrower and deeper and pools have reestablished. Thus, the stream can maintain cooler temperatures with the increased channel depth and reduced water surface exposed to solar radiation.
- Collection of stormwater runoff in detention ponds and reduction of the percentage of impervious surfaces in urban settings can reduce thermal pollution in runoff and can promote infiltration to the local water table where water temperatures are cooled and returned to recharge local streams as base flow.
- Limiting in-stream diversion to maintain adequate in-stream flow and stream depth will reduce water temperature extremes.
- Gravel operations that widen stream channels and/or lower stream bed elevation, thereby leaving adjacent riparian and wetland vegetation "high-and-dry", should be stopped. In New Mexico, most activities that result in fill material (ie. sand, gravel, etc.) entering waters of the U.S. are regulated. The Corps of Engineers and EPA regard the use of mechanized earth-moving equipment to conduct land-clearing, ditching, channelization, in-stream mining and gravel operations, or other earth-moving activity in waters of the United States as resulting in a discharge of dredged material, unless project-specific evidence shows that the activity results in only incidental fallback (33 CFR Ch II part 323.2). Permits are required from the Corps of Engineers and certification from the SWQCB to conduct activities in the waters of the U.S.

The number of beneficial or designated uses usually decreases with declining water quality. Surface water quality temperature criteria are assigned to protect beneficial and designated uses. Temperature modifications from human activities associated with one use, such as livestock watering or in-stream withdrawals, should not compromise the protective needs of other uses within the same stream classification. Moreover, it is critically important that cumulative effects of human activities/uses on water temperature be considered holistically and not individually. A holistic approach is more readily feasible using the watershed geographical area and when all those with an interest in the river are involved. Stream uses and impacts should also be evaluated within an ecosystem context. To be acceptable, all beneficial uses must fit within the temperature regimes provided in nature.

A critical role of the watershed approach is to provide a forum to convey the benefits to the landowner and other stakeholders that will entice them to voluntarily implement modifications to activities and uses of the river already taking place that are causing impairments. Watershed-wide collaborations are a means to implement strategies benefiting users, activities and water quality. Incentives such as improved sport fishing and the influx of recreation dollars into the local economy, enhancement of grazing resources, and increased property values can be demonstrated to promote stewardship of local water resources.

Additional sources of information for BMPs to address temperature are listed below in the Agriculture, Forestry, Riparian and Streambank Stabilization, Roads, Stormwater, and Miscellaneous portions of section 8.5 below. Some of these documents are available for viewing at the New Mexico Environment Department, Surface Water Quality Bureau, Watershed Protection Section Library, 1190 St. Francis Drive, Santa Fe, New Mexico.

Performance Targets

Interim load reduction targets will be used to determine if control actions implemented are successful and standards attained. The interim load reduction targets will be established by the number and kind of BMPs implemented, the number of stream reach miles treated or positively affected by treatment of related areas, and the time it normally takes to see the results of the implemented BMPs. For example, interim load reduction targets will be decreased in stream temperature values as a result of items such as:

- percent success of riparian plantings,
- an increase in the percentage of stream canopy cover, and
- a decrease in the width-to-depth ratio of the stream.

In some cases, the results of implementation and maintenance of the most effective BMPs may likely take years to a decade to achieve.

Interim load reduction targets will be established by SWQB staff and will be re-evaluated periodically, depending on type and timing of BMP implementation. Furthermore, these interim load reduction targets will become part of the watershed remediation plan (WRAS). As additional information becomes available during the identification and quantification of the sources of pollution, the targets, load capacity, and allocations may need to be changed. In the event that new data or information show that changes are warranted, TMDL revisions will be made with assistance of the Upper Rio Chama watershed stakeholders. The re-examination process will involve monitoring pollutant loading, tracking implementation and effectiveness of controls, assessing water quality trends in the waterbody, and re-evaluating the TMDL for attainment of water quality standards. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved.

8.4 Chronic Aluminum

Introduction

The uptake and transport of metals in surface waters can pose a considerable nonpoint source pollution problem. Metals such as aluminum, lead, copper, iron, zinc and others can occur naturally in watersheds in amounts ranging from trace to highly mineralized deposits. Some metals are essential to life at low concentrations but are toxic at higher concentrations. Metals such as cadmium, lead, mercury, nickel, and beryllium represent known hazards to human health. The metals are continually released into the aquatic environment through natural processes, including weathering of rocks, landscape erosion, geothermal or volcanic activity. The metals may be introduced into a waterway via headcuts, gullies or roads. Depending on the

characteristics of the metal, it can be dissolved in water, deposited in the sediments or both. Metals become dissolved metals in water as a function of the pH of a water system. In urban settings, stormwater runoff can increase the mobilization of many metals into streams.

Examples of sources that can cause metals contamination:

- activities such as resource extraction, recreation, some agricultural activities and erosion can contribute to nonpoint source pollution of surface water by metals, and
- stormwater runoff in industrial areas may have elevated metals in both sediments and the water column.

Process

For the Rio Chamita, one of the primary focuses will be on the control of aluminum to the extent possible.

During the TMDL process in this watershed, point sources have been reviewed. Monitoring data from the Village of Chama WWTP have indicated that the facility is potentially contributing aluminum to the Rio Chamita. The WWTP has begun discussing the possibility of moving the discharge to the Rio Chama. SWQB NPDES staff will continue to work with the WWTP to encourage this transfer. During the October 2002, SWQB staff noted several potential sources of aluminum, such as aluminum weirs, screens, and gates. SWQB NPDES staff will encourage the WWTP to replace these fixtures with non-aluminum fixtures to eliminate these potential sources of aluminum.

The nonpoint source contributions will need to address aluminum exceedences through BMP implementation. BMPs can be implemented to address and remediate metal contamination. They include, but are not limited to:

- Improving the pH in a stream -- Neutral to alkaline pH waters will generally not pose a metal exceedence problem. An acidic pH will dissolve available metals. In such a case, a remedy for metals contamination could be an adjustment of the pH of runoff before it enters the water body. An approach may be the construction of an anoxic alkaline drain to raise the pH and precipitate the contained metals. An anoxic alkaline drain is constructed by placing a high pH material in a trench between runoff and the stream to be used as a buffer (Red River Groundwater Investigation- NMED-SWQB-Nonpoint Source Pollution Section, D. Slifer, 1996).
- Installing constructed wetlands -- Wetlands are used to filter runoff water and sediment from source areas in the watershed. Metals may be bound up in the root systems of wetlands vegetation, preventing them from entering a waterway. (The Use of Wetlands for Improving Water Quality to Meet Established Standards, Filas and Wildeman, 1992.)
- Improved stormwater control and construction BMPs -- Stormwater and construction BMPs can be used to divert flows off metal-producing areas directing them away from streams into areas where the flows may infiltrate, evaporate, or accumulate in sediment retention basins. (Conservation Design for Stormwater Management: A Design

Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use, Delaware Department of Natural Resources and Environmental Control, Sediment and Stormwater Program & the Environment Management Center, Brandywine Conservancy, 1997.)

Additional sources of information for BMPs to address chronic aluminum are listed below in the Mining, Riparian and Streambank Stabilization, Stormwater/Urban, and Miscellaneous portions of section 8.5 below. Some of these documents are available for viewing at the New Mexico Environment Department, Surface Water Quality Bureau, Watershed Protection Section Library, 1190 St. Francis Drive, Santa Fe, New Mexico.

Performance Targets

Interim load reduction targets will be used to determine if control actions implemented are successful and standards attained. The interim load reduction targets will be established by the number and kind of BMPs implemented, the number of stream reach miles treated or positively affected by treatment of related areas, and the time it normally takes to see the results of the implemented BMPs. For example, interim load reduction targets will be decreased aluminum values as a result of items such as:

- increases in wetland areas to filter associated reductions in metals concentrations found in the stream,
- increases in stabilized streambanks and enhanced riparian areas to decrease erosion and potential loading of sediment associated with metals into a stream, and
- re-design/upgrades to the current WWTP.

Interim load reduction targets will be established by SWQB staff and will be re-evaluated periodically, depending on type and timing of BMP implementation. Furthermore, these interim load reduction targets will become part of the watershed remediation plan (WRAS). As additional information becomes available during the identification and quantification of the sources of pollution, the targets, load capacity, and allocations may need to be changed. In the event that new data or information show that changes are warranted, TMDL revisions will be made with assistance of the Upper Rio Chama watershed stakeholders. The re-examination process will involve monitoring pollutant loading, tracking implementation and effectiveness of controls, assessing water quality trends in the waterbody, and re-evaluating the TMDL for attainment of water quality standards. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved.

8.5 Additional BMP references and sources of information

Additional sources of information for BMPs to address a variety of landuse practices and concerns are listed below. Some of these documents are available for viewing at the New Mexico Environment Department, Surface Water Quality Bureau, Watershed Protection Section Library, 1190 St. Francis Drive, Santa Fe, New Mexico:

Agriculture

Internet websites -- <http://www.nm.nrcs.usda.gov/>

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Mining

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Holm, J.D., and T. Elmore, 1986, Passive Mine Drainage Treatment Using Artificial and Natural Wetlands. Proceedings of the High Altitude Revegetation Workshop, No. 7. pp. 41-48.

Kleinmann, R.L.P., 1989, Acid Mine Drainage: U.S. Bureau of Mines, Research and Developments, Controlling Methods for Both Coal and Metal Mines. Engineering Mining Journal 190:16i-n.

Machemer, S.D., 1992, Measurements and Modeling of the Chemical Processes in a Constructed Wetland Built to Treat Acid Mine Drainage. Colorado School of Mines Thesis T-4074, Golden, CO.

Metish, J.J. and others, 1998, Treating Acid Mine Drainage From Abandoned Mines in Remote Areas. USDA Forest Service Technology and Development Program, AMD Study 7E72G71, Missoula, MT, US Govt. Printing Office: 1998-789-283/15001.

Royer, M.D., and L. Smith, 1995, Contaminants and Remedial Options at Selected Metal-Contaminated Sites: Battelle Memorial Institute-Columbus Division, under contract # 68-CO-0003-WA41 to Natl. Risk Management Lab-Office of Research and Development, USEPA. EPA/540/R-95/512.

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Roads

Becker, Burton C. and Thomas Mills, 1972, Guidelines for Erosion and Sediment Control Planning and Implementation, Maryland Department of Water Resources, # R2-72-015.

Bennett, Francis William, and Roy Donahue, 1975, Methods of Quickly Vegetating Soils of Low Productivity, Construction Activities, US EPA, Office of Water Planning and Standards Report # 440/9-75-006.

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Constructed Wetlands Bibliography,
www.nal.usda.gov/wqic/Constructed_Wetlands_all/index.html

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USDA Forest Service Southwestern Region, Soil and Water Conservation Practices Handbook, Section 23 Recreation Management, Section 25 Watershed Management, Section 41 Access and Transportation Systems and Facilities.

US EPA, 1993, Guidance Specifying Management Measures For Sources of Nonpoint Pollution in Coastal Waters. Office of Water, Coastal Zone Act Reauthorization Amendments of 1990. EPA840-B-92-002

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